

A key to species of the *Pachyprotasis flavipes* group (Hymenoptera: Tenthredinidae) with two new species from China

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Abstract: The species of *Pachyprotasis flavipes* group in *Pachyprotasis* Hartig from Zhejiang, Hunan and Jiangxi Provinces of China are investigated. Two new species are described: *Pachyprotasis rufofemorata* Zhong, Li & Wei **sp. nov.** and *P. parawui* Zhong, Li & Wei **sp. nov.** A key to all species in the *P. flavipes* group from China is updated.

Key words: Symphyta; Tenthredininae; sawflies; taxonomy; key

中国方颜叶蜂属红足方颜叶蜂种团 *Pachyprotasis flavipes* group 检索表及两新种（膜翅目：叶蜂科）

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摘要: 记述采自中国浙江、湖南及江西的方颜叶蜂属红足方颜叶蜂种团 *Pachyprotasis flavipes* group 2 新种: 红股方颜叶蜂 *Pachyprotasis rufofemorata* Zhong, Li & Wei **sp. nov.** 和拟吴氏方颜叶蜂 *P. parawui* Zhong, Li & Wei **sp. nov.**。更新了中国方颜叶蜂属红足方颜叶蜂种团分种检索表。

关键词: 广腰亚目; 叶蜂亚科; 叶蜂; 分类; 检索表

Introduction

Pachyprotasis Hartig, 1837 is chiefly distributed in the northern Oriental and Palaearctic Regions. Worldwide, 221 species of *Pachyprotasis* have been recognized (Zhong *et al.* 2018). Zhong & Wei (2010) provided a key to separate the *P. flavipes* group from other species-groups of *Pachyprotasis* based on the following characters: hind legs at least hind femur and tibia ed, reddish brown, or reddish yellow, sometimes head and thorax

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red. (In the male, sometimes only traces of that color at the base of tibiae or apex of femora.)

Thirty-two species of the *P. flavipes* group have previously been recorded. One species (*P. variegata*) was found to be widespread throughout Europe and Siberia, twenty-two were described from China and the Burma-Yunnan frontier, eleven are from India and five from Japan. They are, namely, *P. variegata* Fallen, 1808; *P. flavipes* (Cameron, 1902); *P. sanguinipes* Malaise, 1931; *P. maesta* Malaise, 1934; *P. citrinipicta* Malaise, 1945; *P. corallipes* Malaise, 1945; *P. subulicornis* Malaise, 1945; *P. subtilis* Malaise, 1945; *P. subtilissima* Malaise, 1945; *P. validicornis* Malaise, 1945; *P. acutilabria* Wei, 1998; *P. magnilabria* Wei, 1998; *P. parasubtilis* Wei, 1998; *P. rufinigris* Wei & Nie, 1998; *P. weni* Wei, 1998; *P. wui* Wei & Nie, 1998; *P. lineatifemorata* Wei & Nie, 1999; *P. shengi* Wei & Nie, 1999; *P. henanica* Wei & Zhong, 2002; *P. xanthotarsalia* Wei & Nie, 2003; *P. zuoae* Wei, 2005; *P. zhengi* Wei & Zhong, 2006; *P. longipetiolata* Zhong, Li & Wei, 2018; *P. malaisei* Togashi, 1963; *P. sanguinitaris* Togashi, 1963; *P. shishikuensis* Togashi, 1963; *P. manaliensis* Singh, 1987; *P. ramgarhensis* Saini & Kalia, 1989; *P. mandalensis* Saini & Kalia, 1989; *P. punctulatis* Saini & Vasu, 1995; *P. cephalopunctata* Saini & Vasu, 1998, and *P. kulwantae* Saini & Vasu, 1998. In this study, two new species, *P. rufofemorata* Zhong, Li & Wei **sp. nov.** and *P. parawui* Zhong, Li & Wei **sp. nov.** belonging to this species group and collected from Zhejiang, Hunan and Jiangxi Provinces in China are described. A key to all the species from China in this species group is updated.

Material and methods

The specimens were examined with a Motic-DM-143 stereomicroscope. Images of adults were taken with a Keyence VHX-5000 digital camera. Images of genitalia were taken with a Nikon NI-SSR digital camera. All images were further processed with Adobe Photoshop CS 11.0.

Terminology of sawfly genitalia follows Ross (1945), Viitasaari (2002) and Zhong & Wei (2012) and wing venation follows Zhong & Wei (2012).

Specimens examined in this study are deposited in the Central South University of Forestry and Technology, Changsha (CSCS), China, including all holotypes and some paratypes of the new species. Other paratypes of the new species are deposited at the Lishui Academy of Forestry, Lishui, Zhejiang, China (LSAF).

Taxonomy

Key to species of the *Pachyprotasis flavipes* group

1. Hind tarsi black, the apical joints sometimes white or red 2
- . Hind tarsi white or reddish brown, the apical joints sometimes black 10
2. Mesepisternum white, lower sometimes with narrow black band, or mesepisternum black, lower with broad horizontal white band which is not narrower than 1/4 of mesepisternum 3
- . Mesepisternum black, anterior part sometimes with white spot, or lower with narrow horizontal white band which is not broader than 1/4 of mesepisternum 7
3. Mesepisternum black, lower with broad horizontal white band 4
- . Mesepisternum white, lower with a narrow and short black band. China (Tibet); India; Nepal 4

- *P. citrinipicta* Malaise
4. Hind femur red or black, without white, sometimes the extreme base, adjacent to the white trochanters, also a little white 5
- . Basal half or third of hind femur white 6
5. Punctures on mesopleuron deep, distinct; median mesoscutal lobe with yellowish white lateral part; all of laterotergites yellowish white. China (North Area); Japan; Mongolia; Europe; Siberia *P. variegata* Fallen
- . Punctures on mesopleuron shallow, indistinct; apex of median mesoscutal lobe with an arrow-shaped yellowish white spot; laterotergites black, each edge yellowish white. China (Tibet, Yunnan); Burma *P. corallipes* Malaise
6. Dorsal part of head polished, microsculpture absent or indistinct, punctures sparse; apex of median mesoscutal lobe yellowish white. China (Fujian, Hunan, Shaanxi, Zhejiang) *P. wui* Wei & Nie
- . Dorsal part of head opaque, microsculpture distinct, punctures dense; lateral part of median mesoscutal lobe yellowish white. China (Hunan, Jiangxi, Zhejiang) *P. parawui* Zhong, Li & Wei **sp. nov.**
7. Basal half or third of hind femur white; mesopleuron black, without white 8
- . Hind femur reddish brown, without white; lower mesopleuron with white spot. China (Gansu) *P. sanguinipes* Malaise
8. Terga black, without distinct white spot 9
- . Central part of each tergum with a large triangular white spot. China (Gansu, Guizhou, Henan, Hunan, Sichuan, Yunnan) *P. zuoae* Wei
9. Basal half of metafemur striped with black on outer side; base of each serrula distinctly elevated. China (Guizhou, Henan, Hubei, Hunan, Shaanxi) *P. parasubtilis* Wei
- . Metafemur striped with black along the entire length on outer side; base of each serrula indistinctly elevated. China (Henan, Hubei, Shaanxi, Sichuan) *P. lineatifemorata* Wei & Nie
10. Mesepisternum yellowish white, lower sometimes with narrow black band, or mesepisternum black, lower with broad horizontal white band which is not narrower than 1/4 of mesepisternum 11
- . Mesepisternum black, anterior part sometimes with white spot, or lower with narrow horizontal white band which is not broader than 1/4 of mesepisternum 14
11. Lower of mesepisternum white, without black; metacoxa and metafemur without black stripes 12
- . Lower of mesepisternum with a narrow and short black band; outer side of metacoxa and metafemur with black stripes. China (Yunnan) *P. zhengi* Wei & Zhong
12. Basal 1/3 of metafemur yellowish white; upper part of mesopleuron black, lower part yellowish white; occiput black 13
- . Basal 2/3 of metafemur yellowish white; mesopleuron yellowish white, without black; occiput yellowish white. China (Tibet); India *P. subtilissima* Malaise
13. Labrum with squarely pointed anterior margin; hind tarsomeres 2–5 yellowish white; central part of each tergum with a yellowish white short-triangular spot. China (Sichuan, Tibet) *P. flavipes* (Cameron)
- . Labrum with acutely pointed anterior margin; hind tarsus reddish brown, without yellowish white; central part of each tergum with a yellowish brown long-triangular spot. China (Gansu, Henan, Hubei, Shaanxi) *P. acutilabria* Wei
14. Punctures on mesepisternum rough and irregular, surface between punctures opaque 15
- . Punctures on mesepisternum smooth and regular, surface between punctures polished 18
15. Space between punctures on dorsal part of head wider than diameter of punctures, microsculpture absent or indistinct 16
- . Space between punctures on dorsal part of head narrower than diameter of punctures, microsculpture distinct 17

16. Body length 6.5–8.0 mm; center of clypeus with a black spot; each tergum only posterior margin white. China (Sichuan, Yunnan); Burma; India *P. maesta* Malaise
- . Body length 11.0–12.0 mm; clypeus yellowish white, without black; center of each tergum with a distinct white triangular spot. China (Anhui, Fujian, Guizhou, Hunan) *P. xanthotarsalia* Wei & Nie
17. Clypeus yellowish white, without black; metacoxa reddish brown, without black; center of each tergum with a distinct white triangular spot. China (Hunan, Zhejiang) *P. rufinigripes* Wei & Nie
- . Center of clypeus with a black spot; venter of metacoxa with black spot; all terga black, without white spots. China (Anhui, Fujian, Guizhou, Guangdong, Guangxi, Henan, Hubei, Hunan, Shaanxi, Zhejiang); Burma-Yunnan frontier; India *P. subulicornis* Malaise
18. Hind tarsus yellowish white, without reddish brown 19
- . Hind tarsus reddish brown, basal 1/3 of tarsomere 1 and apex of tarsomere 5 black. China (Henan, Hunan, Shaanxi, Sichuan, Yunnan) *P. shengi* Wei & Nie
19. Center of frontal area concave, frontal ridges acute; surface between punctures opaque, microsculpture distinct 20
- . Frontal area distinctly elevated, center not concave, frontal ridges blunt; surface between punctures polished, microsculpture absent. China (Hunan, Zhejiang) *P. rufofemorata* Zhong, Li & Wei **sp. nov.**
20. Clypeus and labrum yellowish white, without black 21
- . Anterior margin and central part of clypeus blackish brown, center of labrum brown. China (Hunan, Zhejiang) *P. longipetiolata* Zhong, Li & Wei
21. Metacoxa yellowish white, ventral side sometimes with black stripe 22
- . Metacoxa reddish brown, without yellowish white. China (Guizhou, Henan, Shaanxi, Sichuan); Burma-Yunnan frontier; India *P. subtilis* Malaise
22. Mesepisternum black, without white 24
- . Ventral part of mesepisternum white, anterior part sometimes with white spot. China (Anhui, Gansu, Guizhou, Henan, Hunan, Zhejiang) *P. henanica* Wei & Zhong
24. Basal 1/10 of metafemur yellowish white; punctures on mesepisternum absent, or extremely minute, shallow. China (Henan) *P. weni* Wei
- . Basal 1/4 of metafemur yellowish white; punctures on mesepisternum moderate. China (Henan) *P. magnilabria* Wei

1. *Pachyprotasis rufofemorata* Zhong, Li & Wei **sp. nov.**

Holotype. Female (Figs 1A–1C), body length 8.5 mm. Body black, with yellowish white pattern as follows: labrum, clypeus, supraclypeal area, lower 1/4 of inner orbit continuous with lower 1/4 of hind orbit, spot on temple, venter of scape and pedicel, tegula except posterior margin, an arrow-shaped spot on apex of median mesoscutal lobe, mesoscutellum except lateral sides, apex of mesoscutellar appendage, metascutellum, medial triangular spots on posterior parts of terga 1–7, most part of terga 8 and 10, basal triangular spots on all of laterotergites, posterior narrow margins of all sterna, lower part of ovipositor basal sheath. Legs yellowish white, with black pattern as follows: narrow dorsal stripe from base of fore and middle tibiae to tarsi, apical 1/7 of metatibia, apex of metatibial spurs, basal 5/7 of hind tarsomere 1; fore and middle femora pale brown; metafemur, metatibia except extreme apex, base of metatibial spurs reddish brown. Wings hyaline, vein C brown, stigma and other veins black brown.

Punctures on labrum and clypeus sparse, minute and shallow; punctures on dorsal part of head minute and shallow, surface between punctures polished, microsculpture absent, strongly

shining; punctures on mesonotum minute and sparse, shining; punctures on upper part of mesepisternum a little large, while ones on lower part minute and sparse, surface between punctures polished, microsculpture indistinct, strongly shining; outer side of mesepimeron with distinct sculptures, sub-shining; punctures on metapleuron dense, minute and shallow, strongly shining; center of mesoscutellum polished without puncture, punctures on lateral side sparse and shallow, strongly shining; mesoscutellar appendage polished, punctures nearly absent, shining; punctures on terga sparse, minute and shallow, surface between punctures with microsculptures and oily luster; outer side of hind coxa with deep and distinct punctures.

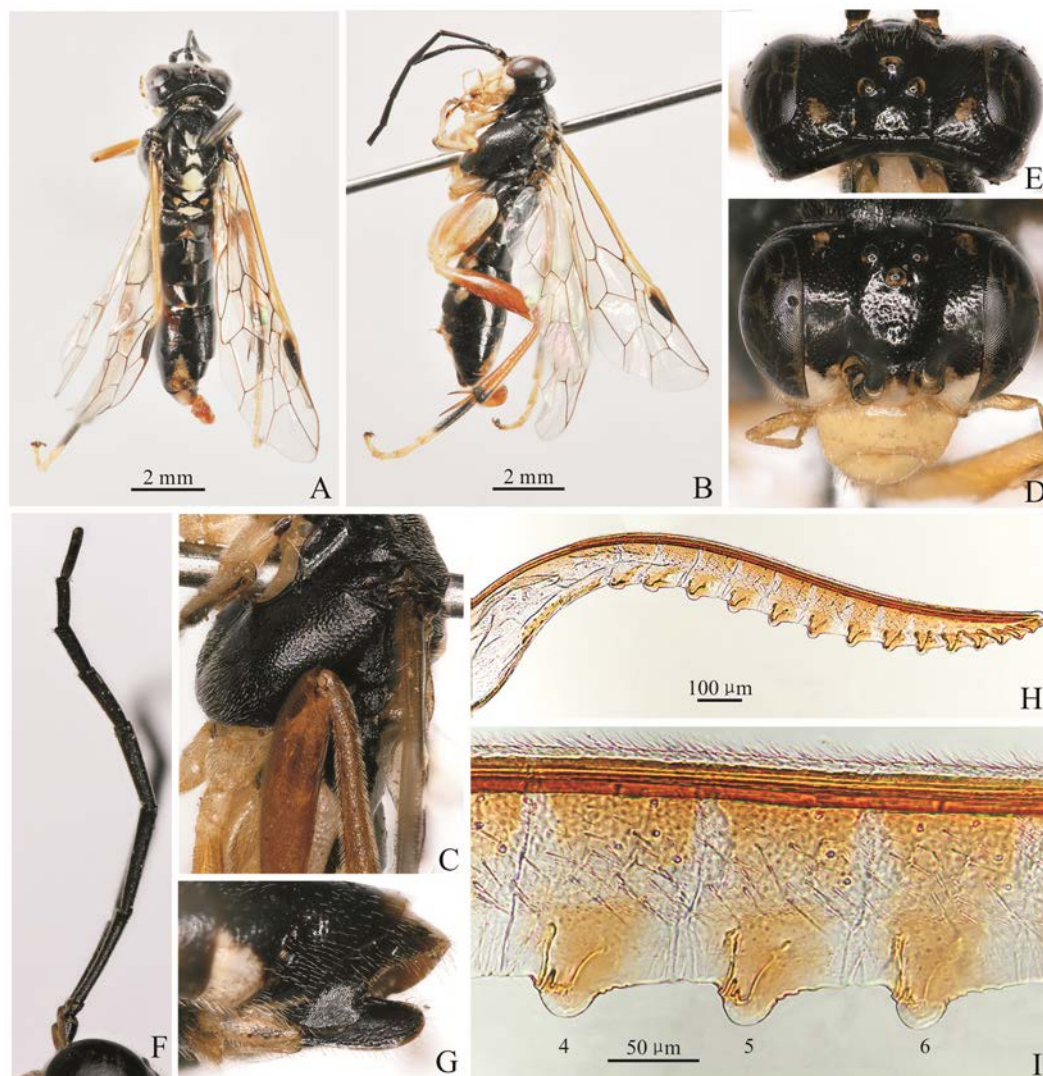


Figure 1. *Pachyprotasis rufofemorata* Zhong, Li & Wei **sp. nov.**, ♀, holotype. A. Adult female, dorsal view; B. Adult female, lateral view; C. Mesopleuron and metapleuron, lateral view; D. Head, frontal view; E. Head, dorsal view; F. Antenna, lateral view; G. Ovipositor sheath, lateral view; H. Lancet; I. Middle serrulae of lancet.

Labrum large and with squarely pointed anterior margin; clypeus truncately incised to 1/3 of its middle length, lateral lobes acute; malar space wider than diameter of median ocellus; inner margins of eyes slightly convergent downwards (Fig. 1D); supra-antennal tubercles and frontal ridges insignificant, frontal area distinctly elevated, above level of eyes in lateral view, median fovea and supra-antennal pit shallow; interocellar furrow wide and shallow, postocellar furrow shallow; postocellar area elevated, broader than long by 2: 1, lateral furrows deep and slightly divergent backwards; head distinctly narrowed behind eyes (Fig. 1E). Antenna shorter than thorax and abdomen together, first flagellomere slightly longer than 2nd flagellomere by 17: 16 (Fig. 1F). Mesoscutellum bluntly elevated, lateral carina rounded, mesoscutellar appendage with blunt middle carina. Metatarsomere 1 longer than following 4 tarsomeres together, claw with inner tooth slightly longer than outer tooth. Front wing with middle petiole of anal cell equal to half length of basal anal cell, distinctly longer than vein R+M; petiole of anal cell on hind wing shorter than half of vein cu-a. Ovipositor sheath distinctly shorter than metatarsomere 1 and round in lateral view, apical sheath slightly longer than basal sheath (Fig. 1G). Lancet with 16 annuli, base of each serrula rounded and strongly elevated, middle serrulae with 2 anterior and 3–4 posterior subbasal teeth (Figs 1H, 1I).

Male. Unknown.

Holotype. ♀, **China**, Hunan, Suining, Huangsang, 110°04'E, 26°26'N, alt. 600–900 m, 21-IV-2005, Shouzhong LIU leg.; **Paratypes.** 1 ♀, **China**, Hunan, Suining, Huangsang, 110°04'E, 26°26'N, alt. 600–900 m, 22-IV-2005, Shouzhong LIU leg.; 1 ♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 405 m, 20-IV-2018, Zejian LI, Mengmeng LIU & Kaiwen GAO leg.; 1 ♀, LSAF14008, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuansi, 119.443°E, 30.322°N, alt. 362 m, 11-IV-2014, Zejian LI leg.; 1 ♀, LSAF17046, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuansi, 119°27'E, 30°19'N, alt. 405 m, 19–20-IV-2017, Tingting JI leg.

Remarks. This species is distinct from other similar species of the *P. flavipes* group by the following characters: frontal area distinctly elevated, above level of eyes in lateral view, frontal ridges insignificant, median fovea pit shaped, shallow; dorsal part of head polished, microsculpture absent; punctures on upper part of mesepisternum a little large, distinct; metacoxa yellowish white, without black stripe; base of each serrula rounded and strongly elevated.

Etymology. The specific epithet “*rufofemorata*” referring to the red hind femur.

2. *Pachyprotasis parawui* Zhong, Li & Wei sp. nov.

Holotype. Female (Figs 2A–2C), body length 8.5 mm. Body black, with yellowish white pattern as follows: labrum, clypeus, supraclypeal area, lower half of inner orbit continuing with lower 3/5 of hind orbit, narrow stripe on upper of inner orbit continuing with oblique spot on temple, tegula except posterior margin, lateral parts of median mesoscutal lobe, a medial butterfly-shaped spot on lateral mesoscutal lobe, mesoscutellum except lateral sides, center of mesoscutellar appendage, metascutellum, a large horizontal band on lower of mesepisternum, posterior part of mesepimeron, metepisternum, posterior part of metepimeron, medial triangular spots on posterior parts of terga 1–8, most part of tergum 10, deflexed lateral sides of all terga, posterior parts of all sterna, lower of ovipositor sheath; ventral part of antenna pale brown. Legs yellowish white, with black pattern as follows: narrow dorsal stripe from basal of

fore and middle femora to tarsi, dorsal part on apex of metafemur, apical 1/3 of metatibia, apex of metatibial spurs, hind tarsus; apical 1/3 of metafemur, basal 2/3 of metatibia and basal 2/3 of metatibial spurs reddish brown. Wings hyaline, stigma and veins black brown.

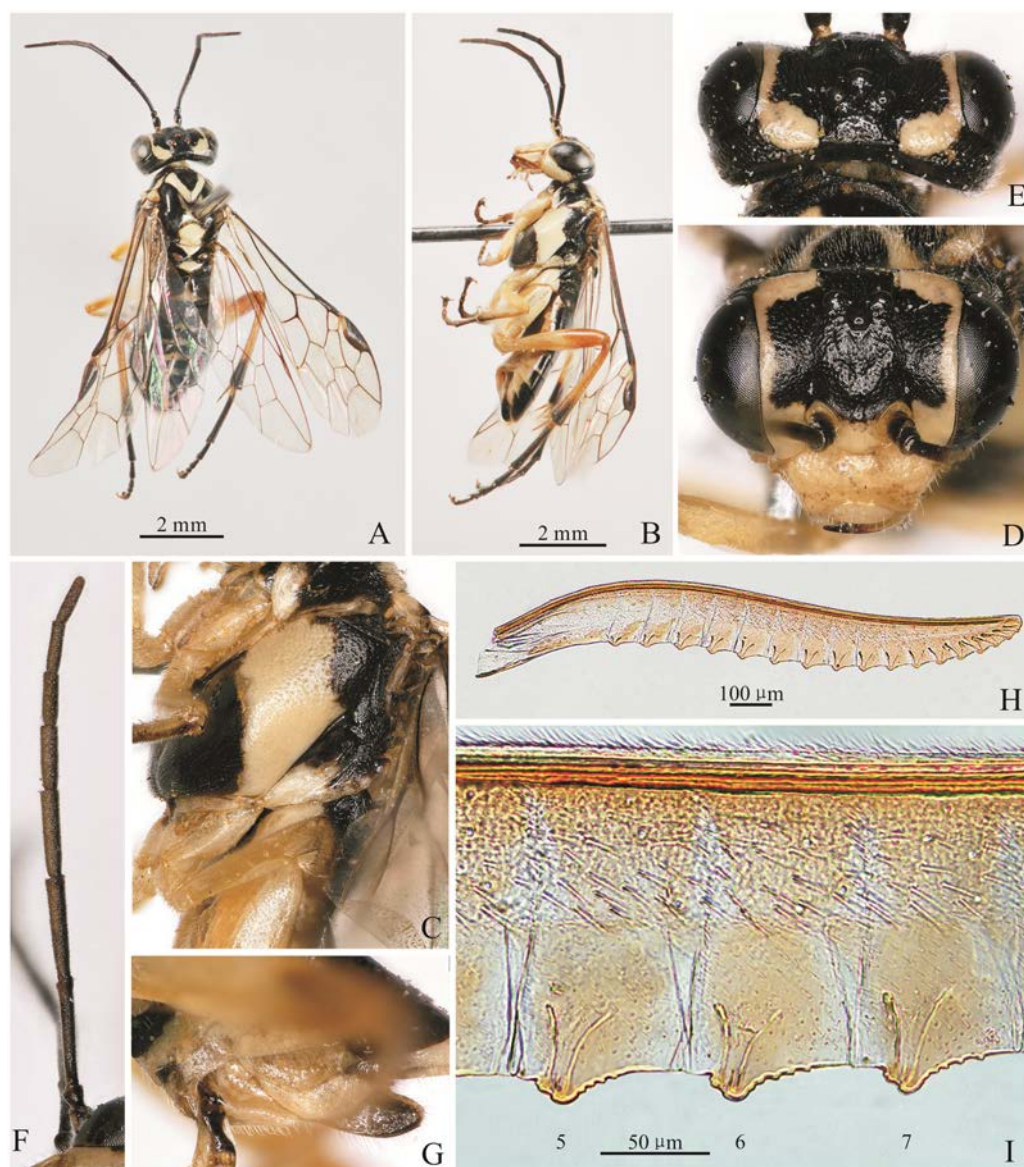


Figure 2. *Pachyprotasis parawui* Zhong, Li & Wei **sp. nov.**, ♀, holotype. A. Adult female, dorsal view; B. Adult female, lateral view; C. Mesopleuron and metapleuron, lateral view; D. Head, frontal view; E. Head, dorsal view; F. Antenna, lateral view; G. Ovipositor sheath, lateral view; H. Lancet; I. Middle serrulae of lancet.

Punctures on labrum and clypeus sparse and shallow; punctures on dorsal part of head minute, shallow and a little sparse, surface between punctures with distinct microsculpture,

shining; punctures on mesonotum minute, shallow and sparse, distinctly shining; punctures on upper part of mesepisternum large, shallow and a little sparse, while punctures on lower part minute and sparse, surface between punctures polished, microsculpture indistinct, strongly shining; outer side of mesepimeron with distinct sculptures, sub-shining; punctures on metapleuron minute, shallow and indistinct, strongly shining; center of mesoscutellum polished without punctures, punctures on lateral side sparse and shallow, strongly shining; mesoscutellar appendage polished, punctures nearly absent, shining; punctures on terga sparse, minute and shallow, surface between punctures with microsculptures and oily luster; puncture on outer side of hind coxa minute, shallow and sparse.

Labrum large and with squarely pointed anterior margin; clypeus roundly incised to 1/3 of its middle length, lateral lobes large; malar space wider than diameter of median ocellus by 3: 2; inner margins of eyes distinctly convergent downwards (Fig. 2D); supra-antennal tubercles insignificant, frontal area distinctly elevated, as high as eyes in lateral view, frontal ridges acute, median fovea insignificant, supra-antennal pit shallow; interocellar furrow short and shallow, postocellar furrow indistinct; postocellar area slightly elevated, broader than long by 3: 2, lateral furrows deep and straight backwards; head indistinctly narrowed behind eyes (Fig. 2E). Antenna distinctly shorter than thorax and abdomen together, first flagellomere longer than 2nd flagellomere by 26: 23 (Fig. 2F). Mesoscutellum bluntly elevated, lateral carina rounded, middle carina of mesoscutellar appendage blunt, indistinctly elevated. Metatarsomere 1 slightly shorter than following 4 tarsomeres together, claw with inner tooth equal to outer tooth. Front wing with middle petiole of anal cell equal to half length of basal anal cell and vein R+M; petiole of anal cell on hind wing equal to half of vein cu-a. Ovipositor sheath slightly shorter than metatarsomere 1 and acute in lateral view, apical sheath longer than basal sheath (Fig. 2G). Lancet with 18 annuli, base of each serrula obliquely elevated, middle serrulae with 2 anterior and 5–6 posterior subbasal teeth (Figs 2H, 2I).

Male. Unknown.

Holotype. ♀, **China**, Hunan, Mt. Yangming, Yongzhou, 111°56'E, 26°04'N, alt. 1000–1300 m, 24-IV-2004, Wei XIAO leg.; **Paratypes.** 1♀, **China**, Hunan, Suining, Huangsang, 110°04'E, 26°26'N, alt. 600–900 m, 21-IV-2005, Wei XIAO leg.; 1♀, **China**, Hunan, Yongzhou, Mt. Shunhuang, 111°03'E, 26°24'N, alt. 900–1200 m, 28-IV-2004, Hu ZHOU leg.; 1♀, **China**, Fujian, Mt. Wuyi, 117°57'E, 27°39'N, 01-V-2005, Mei QIN & Jun XU leg.; 1♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 405 m, 29-III-2018, Mengmeng LIU, Kaiwen GAO & Tingting JI leg.; 2♀, **China**, Jiangxi, Pingxiang, Mt. Wugong, Hongyangu, 114°08'E, 27°29'N, alt. 580 m, 03-IV-2016, Maoling SHENG & Tao LI leg.; 1♀, LSAF14005, **China**, Zhejiang, Lishui City, Liandu District, Mt. Bijia, 119.89°E, 28.47°N, alt. 100 m, 05-IV-2014, Zejian LI leg.; 1♀, LSAF14009, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Nandamen, 119.44°E, 30.30°N, alt. 380 m, 25-III-09-IV-2014, Zejian LI & Lan YE leg.; 1♀, **China**, Zhejiang, Lishui City, Village Xinting, Wetland Jiulong, 119°50'E, 28°24'N, alt. 50 m, 22-III-2015, Zejian LI leg.; 2♀, **China**, Zhejiang, Lishui City, Mt. Baiyun, Taishan, 119°56'E, 28°32'N, alt. 956 m, 30-IV-06-V-2015, Zejian LI leg.; 1♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 362 m, 13-IV-2016, Zejian LI, Mengmeng LIU & Zhiwei CHEN leg.; 1♀, **China**, Jiangxi, Pingxiang, Mt. Wugong, Hongyangu, 114°08'E, 27°29'N, alt. 580 m, 03-IV-2016, Maoling SHENG & Tao LI leg.; 1♀, **China**, Zhejiang, Mt.

Fengyang, Village Luao, 119°12'E, 27°55'N, alt. 1100 m, 22-IV-2017, Zejian LI, Mengmeng LIU & Kaiwen GAO leg.; 1♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 405 m, 19–20-IV-2017, Tingting JI leg.; 2♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 405 m, 28–30-III-2018, Mengmeng LIU, Kaiwen GAO & Tingting JI leg.; 2♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 405 m, 02–03-IV-2018, Zejian LI, Mengmeng LIU, Kaiwen GAO & Tingting JI leg.; 1♀, **China**, Zhejiang, Lin'an District, Mt. Tianmu, Chanyuan Temple, 119°27'E, 30°19'N, alt. 362 m, 05-IV-2019, Zejian LI & Xiufang LI leg.

Remarks. This species is close to *P. wui* Wei & Nie, 1998 in general appearance. The following characters are characteristic of this species: lateral parts of median mesoscutal lobe yellowish white; dorsal part of head with distinct microsculpture; punctures on upper part of mesepisternum large, deep and distinct; middle serrulae with 2 anterior and 5–6 posterior subbasal teeth. In the latter species, only apex of median mesoscutal lobe yellowish white; dorsal part of head polished, microsculpture absent; upper part of mesepisternum minute, shallow and indistinct; middle serrulae with 2 anterior and 12–14 posterior subbasal teeth.

Etymology. This species is named after its resemblance to the similar species, *P. wui* Wei & Nie, 1998.

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